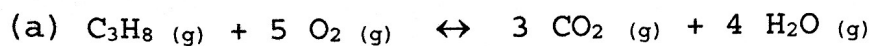


Chemical Equilibrium and the Equilibrium Constant

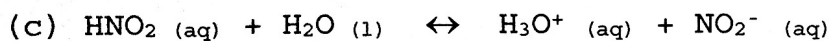
1. Write the equilibrium constant expression for the following. Classify them as homogeneous or heterogeneous equilibria.



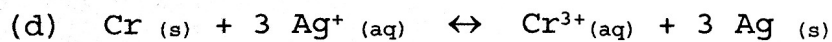
$$K = \frac{[\text{CO}_2]^3 [\text{H}_2\text{O}]^4}{[\text{C}_3\text{H}_8] [\text{O}_2]^5} \quad \text{homogeneous}$$



$$K = [\text{CO}_2] \quad \text{heterogeneous}$$



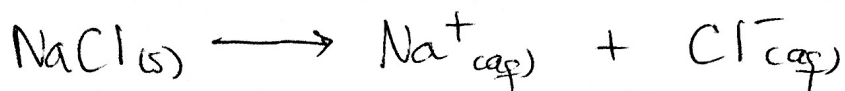
$$K = \frac{[\text{H}_3\text{O}^+] [\text{NO}_2^-]}{[\text{HNO}_2]} \quad \text{homogeneous}$$



$$K = \frac{[\text{Cr}^{3+}]}{[\text{Ag}^+]^3} \quad \text{heterogeneous}$$

2. Consider the dissolution of two salts, NaCl and AgCl, in water:

- a. Write the chemical equation for the dissolution of each salt and the corresponding equilibrium constant expression.
- b. Based on the value of the equilibrium constant, classify salts as soluble or insoluble: NaCl: $K=38$ and AgCl: $K=1.8 \times 10^{-10}$



$$K = [\text{Na}^+][\text{Cl}^-] = 38$$

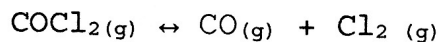
$K > 1$ Products favored \Rightarrow Soluble salt



$$K = [\text{Ag}^+][\text{Cl}^-] = 1.8 \times 10^{-10}$$

$K \ll 1$ Reactant favored \Rightarrow Insoluble salt.

3. Consider the following reaction:



- (a) Write the equilibrium constant expression.
- (b) An equilibrium mixture contains the following concentrations at 100°C : $[\text{COCl}_2]=0.0100\text{M}$, $[\text{CO}]=1.48 \times 10^{-6}\text{M}$, $[\text{Cl}_2]=1.48 \times 10^{-6}\text{M}$. Calculate K_c .
- (c) Which reaction is favored, forward or reverse?

$$K = \frac{[\text{CO}][\text{Cl}_2]}{[\text{COCl}_2]}$$

$$= \frac{(1.48 \times 10^{-6})(1.48 \times 10^{-6})}{(0.0100)} = 2.19 \times 10^{-10}$$

$K \ll 1$ Reverse R is favored (reactants)